

REMARKS

Claims 1-11 are pending. Claims 1, 2 and 5 are currently amended. Claim 6 is canceled.

The current amendment of claim 1 changes the concentration of the tetraalkylorthosilicate in the mixture to being in the range of from at least about 2200 ppm to 10,000 ppm. The instant specification supports the amendment, including on page 5, at line 11. Also, the current amendment of claim 1 recites a balance gas that contains at least one oxygen atom. The instant specification supports this amendment, including original claim 6, in part, and page 4, lines 8 and 9. This paper cancels claim 6 as being redundant in view of the latter amendment of claim 1.

Claim Rejections – Double Patenting

In the Office Action, claims 1-3 and 5 are rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1, 6, and 13 of U.S. Patent No. 6,815,014 in view of Koinuma (EP 0617142 A1). It was argued in the Office Action that Koinuma mentions a concentration range of 33 parts per million (ppm) to 10,000 ppm for a particular tetraalkylorthosilicate, namely tetraethylorthosilicate (TEOS).

Applicants disagree with the rejection. Koinuma teaches that it is desirable to employ a significantly higher feed rate of balance gas than a feed rate of working gas. Whereas, the present invention method has achieved a 10-fold increase in deposition rate by employing the claimed ppm concentration range of “from at least about 2200 ppm to 10000 ppm” of tetraalkylorthosilicate (working gas) and, in currently amended claim 1, an oxygen-containing balance gas and by significantly decreasing the flow velocity of a total gas mixture, wherein controlling relative flow rates of the oxygen-containing balance gas and the tetraalkylorthosilicate determines concentration of the tetraalkylorthosilicate in the total gas mixture. And yet the present invention method still produces a coating that is an essentially monolithic, optically clear, contiguous SiO_x film coating and is essentially powder-free or substantially powder-free.

As mentioned above, Koinuma teaches that it is desirable to employ a significantly higher feed rate of balance gas than a feed rate of working gas. Koinuma teaches a silane gas as a working gas. The only balance gas mentioned in Koinuma is hydrogen gas. Koinuma does not teach or suggest using a balance gas containing an oxygen atom. Page 4, lines 2-4, of Koinuma also teaches that a feed rate by volume of hydrogen gas any lower than 10 times a feed rate by volume of the silane gas should be avoided. This is because the lower feed rate of hydrogen gas may cause an unwanted increase in carbon content and a lowering of hardness, despite a desirable increased deposition rate.

As described in the instant specification on page 7, lines 21-26, the present invention has achieved the 10-fold increase in deposition rate by significantly increasing the concentration of the tetraalkylorthosilicate and significantly decreasing the flow velocity of the total gas mixture. Also, as described in the instant specification on page 4, at lines 27-30, the present invention method determines concentration of the tetraalkylorthosilicate in the total gas mixture and contributes to quality of the coating formed on the substrate by controlling the relative flow rates of the balance gas and the tetraalkylorthosilicate. In currently amended claim 1, the balance gas contains an oxygen atom. The process of the present invention rapidly deposits continuously on a substrate a coating having desirable characteristics. These characteristics include being an essentially monolithic, optically clear, contiguous SiO_x film coating that is essentially powder-free or substantially powder-free. Indeed, there the instant specification mentions that the 10-fold increase of deposition rate and desirable coating characteristics have been achieved by significantly increasing the concentration of the tetraalkylorthosilicate and significantly decreasing the flow velocity of the total gas mixture through the perforations of the electrode. The concentration of the tetraalkylorthosilicate is significantly increased by employing a ppm concentration range of "from at least about 2200 ppm to 10000 ppm" in the present invention, as mentioned in the instant specification on page 5, at lines 8-12.

As noted on pages 2-3 of the Office Action, U.S. Patent No. 6,815,014 does not teach the instant concentration range for a tetraalkylorthosilicate working gas. As noted on page 5 of the Office Action, Koinuma does not explicitly teach a TEOS concentration range of from

at least about 2000 ppm to 10000 ppm. Applicants note that Koinuma also does not explicitly teach a TEOS concentration range of from at least about 2200 ppm to 10000 ppm. Further, as mentioned previously, Koinuma stresses importance of a ratio of hydrogen balance gas to silane working gas. Applicants believe that Koinuma's ratio of hydrogen balance gas to silane working gas would affect the concentration of TEOS in a total gas mixture and is relevant only when balance gas is hydrogen, which is known to increase carbon content in a coating. And so Applicants believe that any TEOS concentration range taught by Koinuma is not applicable to teach a concentration range of the instant tetraalkylorthosilicate in a total gas mixture comprising an oxygen-containing balance gas, which is an oxidant and thus not known to increase carbon content in a coating. Accordingly, Applicants believe that selecting the instant tetraalkylorthosilicate concentration range of from at least about 2200 ppm to 10000 ppm, in combination with limiting a balance gas to an oxygen-containing balance gas, in the process of U.S. Patent No. 6,815,014 would not have been obvious in view of Koinuma.

Further, Applicants believe that the instant claimed invention is not obvious because of unexpected results that have been achieved by the process of the present invention. These unexpected results include the aforementioned increased deposition rate and coating quality benefits of a tetraalkylorthosilicate ppm concentration range of "from at least about 2200 ppm to 10000 ppm." Applicants believe these results would have been unexpected over U.S. Patent No. 6,815,014 in view of Koinuma at the time of the present invention.

Accordingly, Applicants believe that the process of claim 1, and thus of dependent claims 2, 3 and 5, is nonobvious over U.S. Patent No. 6,815,014 in view of Koinuma and patentable under the judicial doctrine of nonstatutory obviousness-type double patenting.

Claim Rejections – 35 U.S.C. §102

In the Office Action, claims 1, 2, 5-7, and 11 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Babayan (WO 00/70117). It was argued in the Office Action that Babayan uses a TEOS concentration that is greater than 2000 ppm.

Applicants disagree with the rejection. Babayan apparently teaches a TEOS concentration of 2003 ppm.¹ A TEOS concentration of 2003 ppm does not anticipate currently amended claim 1 or, for that matter, dependent claims 2, 5-7, and 11. Accordingly, claims 1, 2, 5-7, and 11 are novel over Babayan and patentable under 35 U.S.C. §102(b).

In the Office Action, claims 1 and 9 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Koinuma. Applicants disagree with the rejection. As mentioned previously in this paper, the only balance gas mentioned in Koinuma is hydrogen gas. In currently amended claim 1, the balance gas is air, oxygen, CO₂, O₃, NO, or a combination thereof. Accordingly, claim 1 and dependent claim 9 are novel over Koinuma and patentable under 35 U.S.C. §102(b).

Claim Rejections – 35 U.S.C. §103

In the Office Action, claims 1 and 9 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Koinuma. Applicants disagree with the rejection because, as previously mentioned in this paper, Applicants believe that any TEOS concentration range taught by Koinuma is not applicable to teach the instant concentration range of tetraalkylorthosilicate and, separately, because of the unexpected results achieved by the process of the present invention. Accordingly, Applicants believe that claims 1 and 9 are nonobvious over Koinuma and patentable under 35 U.S.C. §103(a).

In the Office Action, claims 1-11 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Gabelnick WO (WO 03/066932) or Gabelnick WO in view of Koinuma. It was stated in the Office Action that Gabelnick WO teaches a ppm preferably not greater than 2000 ppm. It was argued in the Office Action that it would have been obvious to one of ordinary skill in the art at the time of the invention to use any amount of TEOS up to 10000 ppm as taught by Koinuma in a plasma polymerized deposition process of Gabelnick WO.

¹ Applicants calculated this apparent concentration value using the following inputs: flow rates of 17.70 milligrams per minute (mg/min) of TEOS, 42.30 liters per minute (L/min) of helium, and 0.8500 L/min of oxygen gas, which flow rates are mentioned in Babayan on page 30, line 23, to page 31, line 1; and gas densities at atmospheric pressure and temperature are as follow: an oxygen gas density of 1.429 grams per liter (g/L) and a helium density of 0.1800 g/L.

Applicants disagree with the rejection. As mentioned in the Office Action, Gabelnick WO prefers a concentration range not greater than 2000 ppm. The concentration range of tetraalkylorthosilicate in instant claim 1 has been amended as described previously in this paper to a range of "from at least about 2200 ppm to 10000 ppm." This concentration range would not have been obvious over Gabelnick WO or over Koinuma in view of Koinuma because, as previously mentioned in this paper, Applicants believe that any TEOS concentration range taught by Koinuma is not applicable to teach the instant concentration range of tetraalkylorthosilicate and, separately, because of the unexpected results achieved by the process of the present invention. Accordingly, Applicants believe that claims 1-11 are nonobvious over Gabelnick WO or over Gabelnick WO in view of Koinuma and are patentable under 35 U.S.C. §103(a).

In the Office Action, claims 2-4 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Koinuma as applied to claim 1 and further in view of Yializis (US Patent No. 6,118,218). It was argued in the Office Action that it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the perforated electrode in the atmospheric plasma treatment method of Yializis to the glow discharge plasma silica film forming method of Koinuma.

Applicants disagree with the rejection because, as previously mentioned in this paper, Koinuma teaches the importance of the ratio of the hydrogen balance gas to TEOS working gas whereas instant claim 1 requires an oxygen-containing balance gas and further the process of the present invention achieves unexpected results. Accordingly, Applicants believe that claims 2-4 are nonobvious over Koinuma in view of Yializis and patentable under 35 U.S.C. §103(a).

In the Office Action, claims 1-5, 7 and 8 are rejected under 35 U.S.C. §103(a) as allegedly being obvious over Yializis in view of Koinuma. It was argued in the Office Action that it would have been obvious to one of ordinary skill in the art at the time of the invention to

apply the use of a tetraalkylorthosilicate gas to create a silica film via glow discharge plasma as taught by Koinuma to the atmospheric plasma treatment method of Yializis.

Applicants disagree with the rejection because, as previously mentioned in this paper, Applicants believe that any TEOS concentration range taught by Koinuma is not applicable to teach the instant concentration range of tetraalkylorthosilicate and, separately, because of the unexpected results achieved by the process of the present invention. Accordingly, Applicants believe that claims 1-5, 7 and 8 are nonobvious over Yializis in view of Koinuma and patentable under 35 U.S.C. §103(a).

In the Office Action, claim 11 is rejected under 35 U.S.C. §103(a) as allegedly being obvious over Koinuma in view of Sloodman (US Patent No. 5,576,076). It was argued in the Office Action that it would have been obvious to one of ordinary skill in the art at the time of the invention to try the experiment of Koinuma and determine the surface energy as taught by Sloodman.

Applicants disagree with the rejection because, as previously mentioned in this paper, Applicants believe that any TEOS concentration range taught by Koinuma is not applicable to teach the instant concentration range of tetraalkylorthosilicate and, separately, because of the unexpected results achieved by the process of the present invention. Accordingly, Applicants believe that claim 11 is nonobvious over Koinuma in view of Sloodman and patentable under 35 U.S.C. §103(a).

The undersigned would welcome a telephone call to advance prosecution.

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